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Opinion Article

Epidemiology of *Plasmodium falciparum* and *Plasmodium vivax* Gametocyte Transmission of Malaria

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DESCRIPTION

An anopheles mosquito bite from a female transmits the *Plasmodium* parasite, which causes malaria, into the bloodstream. Plasmodium infection occurs in humans and mosquitos because of sporozoite and gametocyte entry, respectively. One of the main causes of illness and mortality worldwide is still malaria. The estimated numbers of malaria cases and fatalities were 241 million and 627 thousand, respectively. The majority of malaria cases occur in Sub-Saharan Africa, particularly affecting pregnant women and young children under the age of five.

More than 90% of death from malaria worldwide is caused by *Plasmodium falciparum* (*P. falciparum*), while *Plasmodium vivax* (*P. vivax*) is the most prevalent species. Malaria's destructive effects persisted despite international efforts. The mainstay of the malaria fight has been vector control methods as Indoor Residual Spray (IRS) and Insecticide Treated Nets (ITNs). The possibility of eradicating malaria through preventing transmission has increased to recent developments in diagnosis, treatment, and research. A transmission-blocking approach recommended for the eradication of malaria is improved case care with combination medication.

In order to organize and evaluate extermination groups, molecular epidemiology can offer crucial information about the genetic diversity and transmission of *Plasmodium falciparum*. Information on malaria molecular epidemiology, which includes knowing the genetic variety of the parasite and doing molecular surveillance of transmission. A practical, quick, and high-throughput technique to understanding the genetics of the malaria population is provided by Next-Generation Sequencing (NGS). Using the NGS platform, this study attempts to decipher the *P. falciparum* population structure and calculate the allelic diversity, Multiplicity of Infection (MOI), and evolutionary tendencies of the malaria parasite. The most prevalent and severe malaria parasite in humans, *Plasmodium falciparum*, causes 92% of malaria cases and 93% of malaria-related deaths worldwide (99.7% mortality rate).

Understanding malaria epidemiological patterns, including the dynamics of transmission, human exposure to mosquito bites, development of malaria immunity, and evaluation of malaria control methods, depends on the level of genetic diversity and Multiplicity of Infection (MOI). In malaria molecular epidemiology, the polymorphic antigens *Plasmodium falciparum* merozoite surface protein 1 and merozoite surface protein 2 have been widely researched. Assessing the allelic diversity and figuring out MOI can be done by genotyping the polymorphic areas of the relevant genes using polymerase chain reaction (PCR). These two markers have so been employed extensively in earlier research to assess genetic diversity, population structure, and MOI.

Malaria elimination means cessation of parasite transmission. The incidence of malaria is currently dropping in many countries, putting elimination a clear objective. Hence, the national malaria control programmes have placed a focus on transmission control. Transmission control has thus been placed at the center of the national malaria control programs. A major element in the persistence of malaria in endemic areas is the effective transfer of *Plasmodium vivax* from people to mosquitoes. The success of eradication attempts depends on having a better understanding of transmission. For the purpose of selecting and ranking novel targets for intervention, biological delineation of the parasite transmission pathway is crucial. For an elimination approach to be successful, it is essential to identify the community's infectious parasite reservoir.

The parasitophorous vacuolar membrane of the red blood cell is where the gametocytes are found. Red blood cells harbouring a *P. vivax* gametocyte and an asexual parasite both have a small enlargement. Under a light microscope, young *P. vivax* gametocytes can be recognised from the stage because they are compact, non-ameboid, and lack a vacuole. Osmiophilic bodies, a type of black pigment grain found in the cytoplasm, are a distinguishing feature of gametocytes. *P. vivax* male and female gametocytes share a similar morphology, however the size of the nucleus allows for differentiation.

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